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EVALUATION OF CONELET ABORTION IN TWO LONGLEAF SEED ORCHARDS AND THREE NATURAL STANDS IN NORTH AND SOUTH CAROLINA

By

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ABSTRACT

For the last several years, cone and subsequent seed production in some longleaf orchards have been extremely low, mainly attributed to early conelet mortality. A conelet survey, beginning in March 1979, and ending in August 1979, was made to determine the frequency and distribution of conelet abortion in two longleaf seed orchards and three natural stands. Areas surveyed are located in and around the longleaf seed orchards in the Francis Marion National Forest in South Carolina and the Bladen Lakes State Orchard in North Carolina. Results showed that there was little difference in the percentage of conelets lost in the orchard as compared to the natural stands in South Carolina. In North Carolina, however, there was a higher percentage of conelets lost in the orchard than in the natural stands with the greatest losses occurring between May 7 and June 5.

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INTRODUCTION

Early conelet mortality in the longleaf pine (Pinus palustris Mill.) has been reported from various locations in the South for the past several years (McLemore 1977). In the case of some orchard clones, conelet loss has reached 100 percent. In 1975, the USFS seed orchard in Moncks Corner reported a 97 percent conelet mortality (Buckles, Bramlett, and Miller 1977). Investigators at Bladen Lakes reported losses from 85 to 100 percent from 1971-1975 (Summerville, Jett, and Davey 1978).

Most of the abortion occurs 6 to 10 weeks after the female strobili close; i.e., after it has been pollinated but before fertilization. After pollination, the small female strobilus is considered a conelet Pollination occurs in early March when the strobili are about 3/4 to 1 inch long. Early in this stage, which lasts approximately 1 year until the conelet enlarges, the abortion occurs. There are various suspected causes for the high loss of conelets--insect damage, competition for nutrients, lack of viable pollen, pathogenic fungi, severe weather conditions, water stress, etc.(Summerville, et al., 1978).

The purpose of this survey was to determine if there is a difference in abortion rates between orchards and natural stands. This information is particularly important to the longleaf orchard managers and researchers attempting to determine the cause. Since seeds from these orchards are the target crop and are produced at considerable cost, their loss is significant.

METHODS

The survey was conducted in two different locations (Figs. 1, 2 and 3)--one in and around the longleaf seed orchard on the Francis Marion National Forest in South Carolina, and the other in the Bladen Lakes State Orchard and surrounding forest in North Carolina.

At the Francis Marion there are three survey plots--one in the seed orchard and two in natural stands. The natural stands are 3 and 10 miles from the orchard. Since 1978-1979 was a poor year for flowering, trees were selected by sight. Originally, a random sampling would have been the basis for selection; however, it became evident that many trees bore too few flowers to insure an adequate sample both in the orchard and natural stands. Thus, trees were chosen if they produced approximately 20 or more flowers.

Fifteen trees were inventoried in the orchard. On these 15 trees, a total of 506 flowers were tagged with red flagging and aluminum labels for reexamination every 5 to 6 weeks until September. One hundred and seventy-eight 1978 healthy conelets were tagged with blue flagging.

FIGURE 1: LOCATION OF TWO LONGLEAF STUDY AREAS IN NORTH CAROLINA AND SOUTH CAROLINA, 1979.

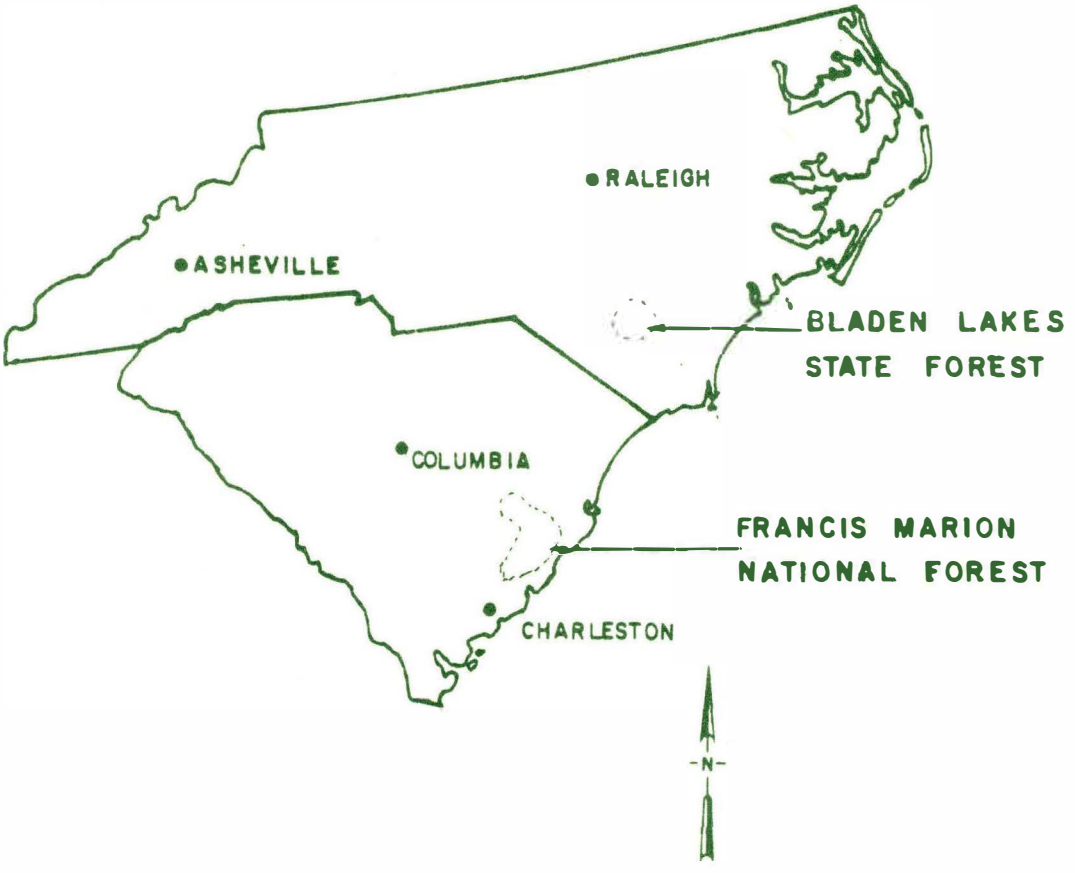


FIGURE 2 LOCATION OF SEED ORCHARD AND NATURAL STANDS IN THE FRANCIS MARION NATIONAL FOREST, IN SOUTH CAROLINA.

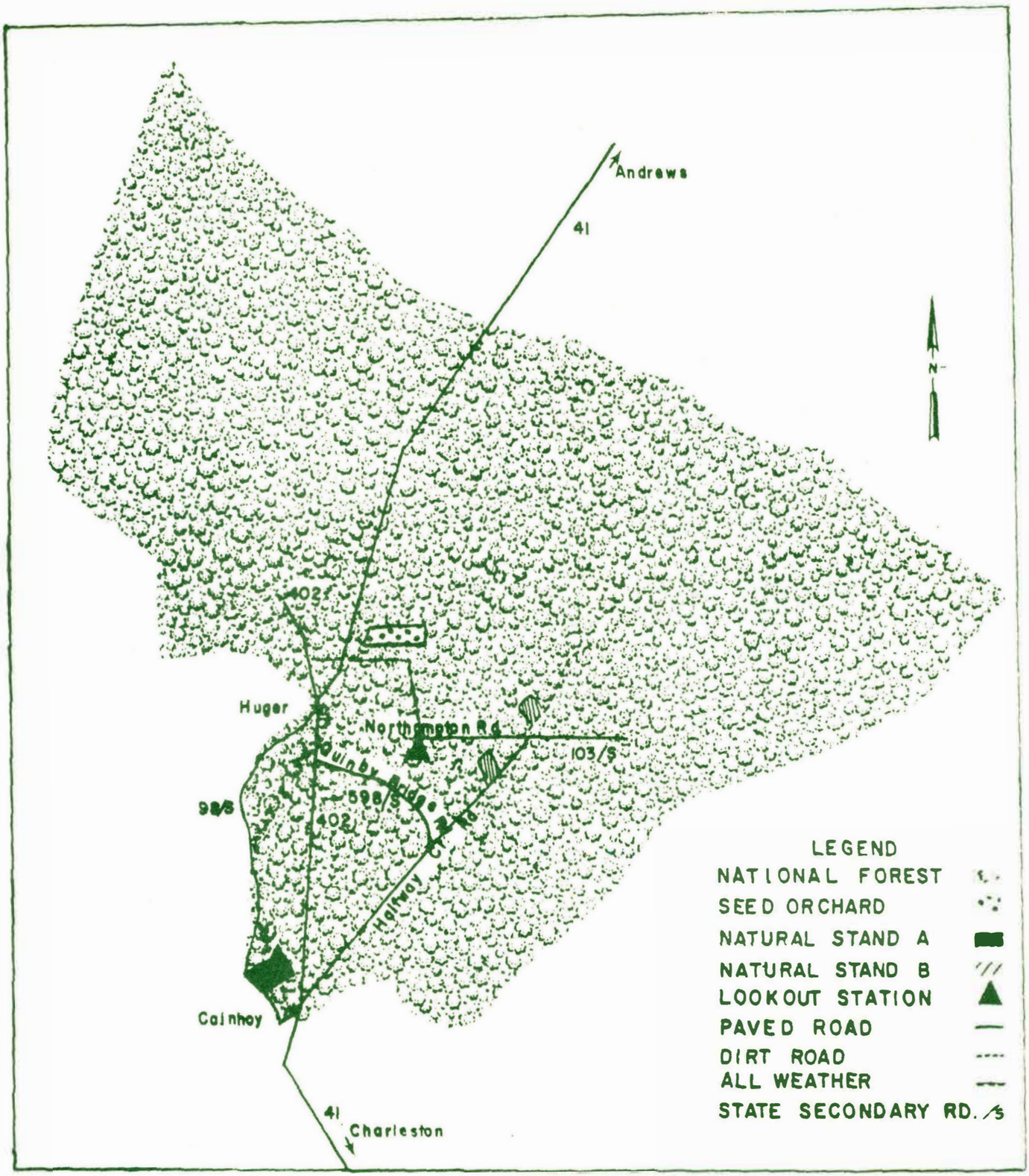
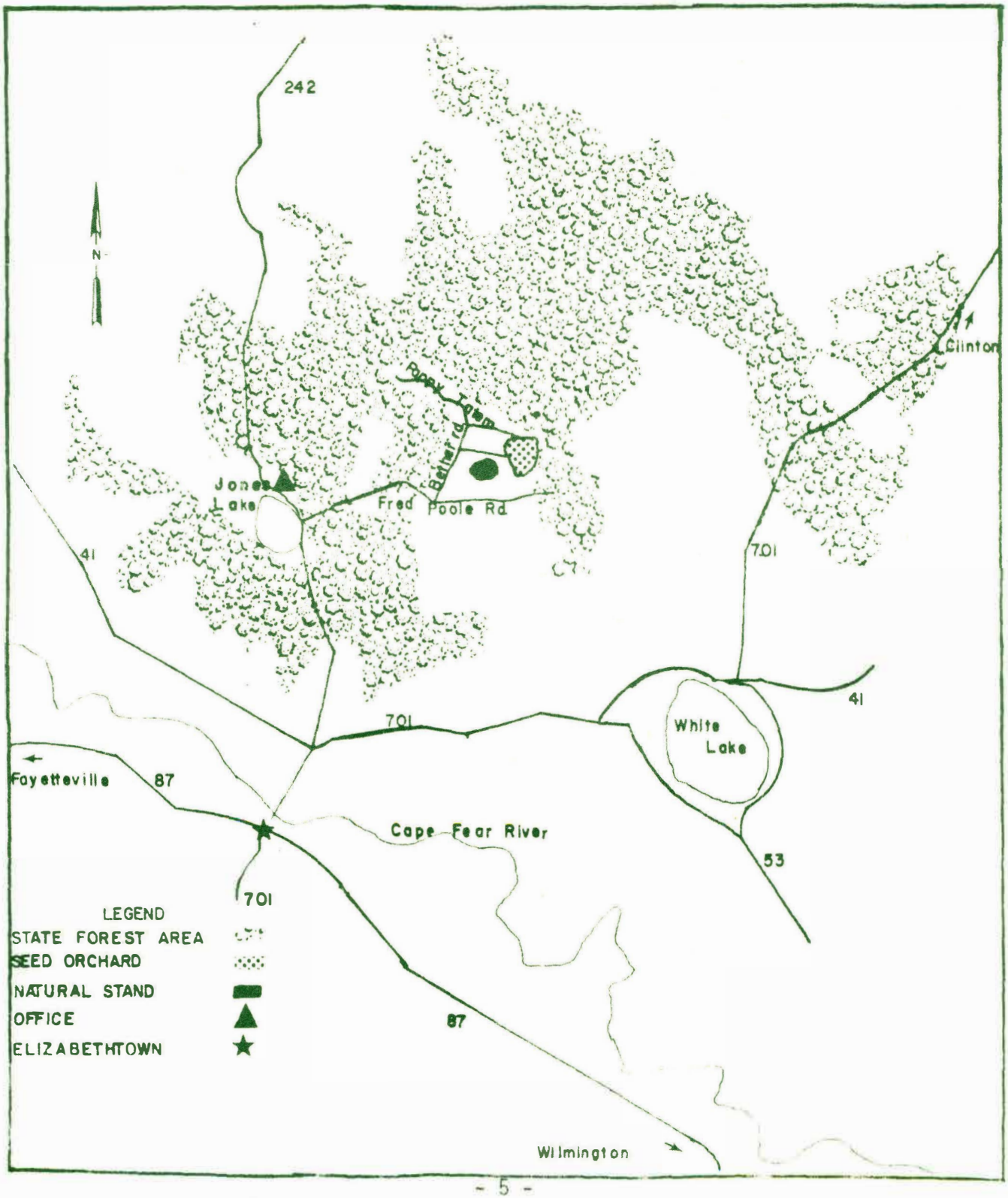


FIGURE 3: LOCATION OF SEED ORCHARD AND NATURAL STAND IN THE BLADEN LAKES STATE FOREST IN NORTH CAROLINA.



In Natural Stand A, 365 flowers and 31 1978 conelets were tagged.
In Natural Stand B, 330 flowers and 103 1978 conelets were tagged (Fig. 2).

In the Bladen Lakes area selection procedures were the same as those on the Francis Marion. As in the Francis Marion, the orchard plot chosen had been treated with Furadan . Fifteen trees were inventoried in the orchard. One hundred and seventy-seven flowers and two hundred and thirty-seven 1978 conelets were flagged. The flowering in the Bladen Lakes orchard was considerably lower than at the Francis Marion orchard.

Only one natural stand was studied at Bladen Lakes. It is approximately 1 mile from the orchard. Two hundred and fifty-eight flowers and eleven 1978 conelets were tagged.

Originally, a second natural stand was chosen on the Sandhills Wildlife Management area near Southern Pines, N.C. A thorough site examination was made in April of the tree crowns at two locations--Compartment No. 2, Gliden Field, and Compartment No. 20, Little Muddy. There was such a small number of flowers in this area the survey there was abandoned.

At both locations in the orchards and natural stands, a Hi-Ranger bucket truck was used. For this reason, trees in the natural stands had to be close to access roads. The Hi-Ranger, with a 48-foot boom, allowed for observation in the older, larger longleaf pines to that height. The truck was equipped with a 2-person bucket. Observational procedures involved one technician actually observing the branches, searching through the needles for flowers, cones, and male catkins while the other technician prepared tags with labels and flagging. The aluminum tags were large enough (approximately 1" x 3") for the following information: date, tree clone number, branch number, number female flowers, and number of 1978 conelets. Developing conelets, classified as healthy, moribund, partially necrotic, necrotic, and missing were the primary targets. Information recorded on the tags corresponded to a similarly numbered data sheet.

The first observations were made during the week of March 19-29 in the Francis Marion area and April 16-26 in the Bladen Lakes area. These initial observations also included male catkins which were visible at that time. The mature cones from 1977 flowers were not inventoried.

The second and third observations involved another inventory of the development of female strobili, formally referred to as flowers. The second series of observations were made after 7 weeks (May 8-10) and 9 weeks (June 19-22) on the Francis Marion and Bladen Lakes forests, respectively. The third and final observations at Bladen Lakes were made after 13 weeks from July 17-20. The third and fourth observations at the Francis Marion were made after 11 weeks (June 5-8) and 16 weeks (July 10-13), respectively. Due to time limitations, a fourth series of readings was not carried out at Bladen Lakes. Additional readings planned for late August on the Francis Marion were canceled because of Hurricane Frederic.

RESULTS

Losses were consistently higher at Bladen Lakes than on the Francis Marion (Tables 1 and 2). This relationship continued throughout the study even though there was a 3-week difference in the timing of the last count. The natural stand and seed orchard losses were both higher than any of the areas on the Francis Marion. The seed orchard, however, showed higher losses than the natural stand. On the Francis Marion, the reverse occurred. The losses within the seed orchard were lower than either natural stand. After 9 weeks, the natural stand at Bladen Lakes had lost about 31 percent of its conelets. At the Francis Marion, the 11-week average of the two natural stands was a similar 32.2 percent.

At the time of the final count at Bladen Lakes in July, 98 percent of the conelets had aborted in the orchard. However, after 16 weeks, 42.8 percent aborted on the Francis Marion. Thus, losses at the time of final counts on the Francis Marion were about one half those at Bladen Lakes.

At Bladen Lakes, conelet mortality followed a nearly straight line (Fig. 4). On the Francis Marion, the rate of mortality increased somewhat between the first week of May and the first week of July (Fig. 5).

DISCUSSION

It was not our purpose in this survey to determine the cause of conelet mortality. It was our objective to observe differences in losses in seed orchards and surrounding natural stands. Only one cause of mortality was observed and that was damage by a species of Dioryctria.

The data collected over the total of 16 weeks show that the percentage of conelets that aborted in North Carolina is twice that of those in South Carolina. The cause of this difference was not observed, yet it does not appear to be strictly the results of orchard practices since natural stand curves are similar although lower.

The 1978-79 season was a poor flowering season. This fact not only lowered the number of flowers available, but also affected the original design. For these reasons, we feel that the study should be continued for another year. Trees counted this year will be recounted as well as additional ones. In the orchards more replicates per clone will be inventoried. In addition, more natural stands will be included.

Fig. 4 NUMBER OF SURVIVING CONELETS FROM MARCH TO JULY ON THE BLADEN LAKES STATE FOREST.

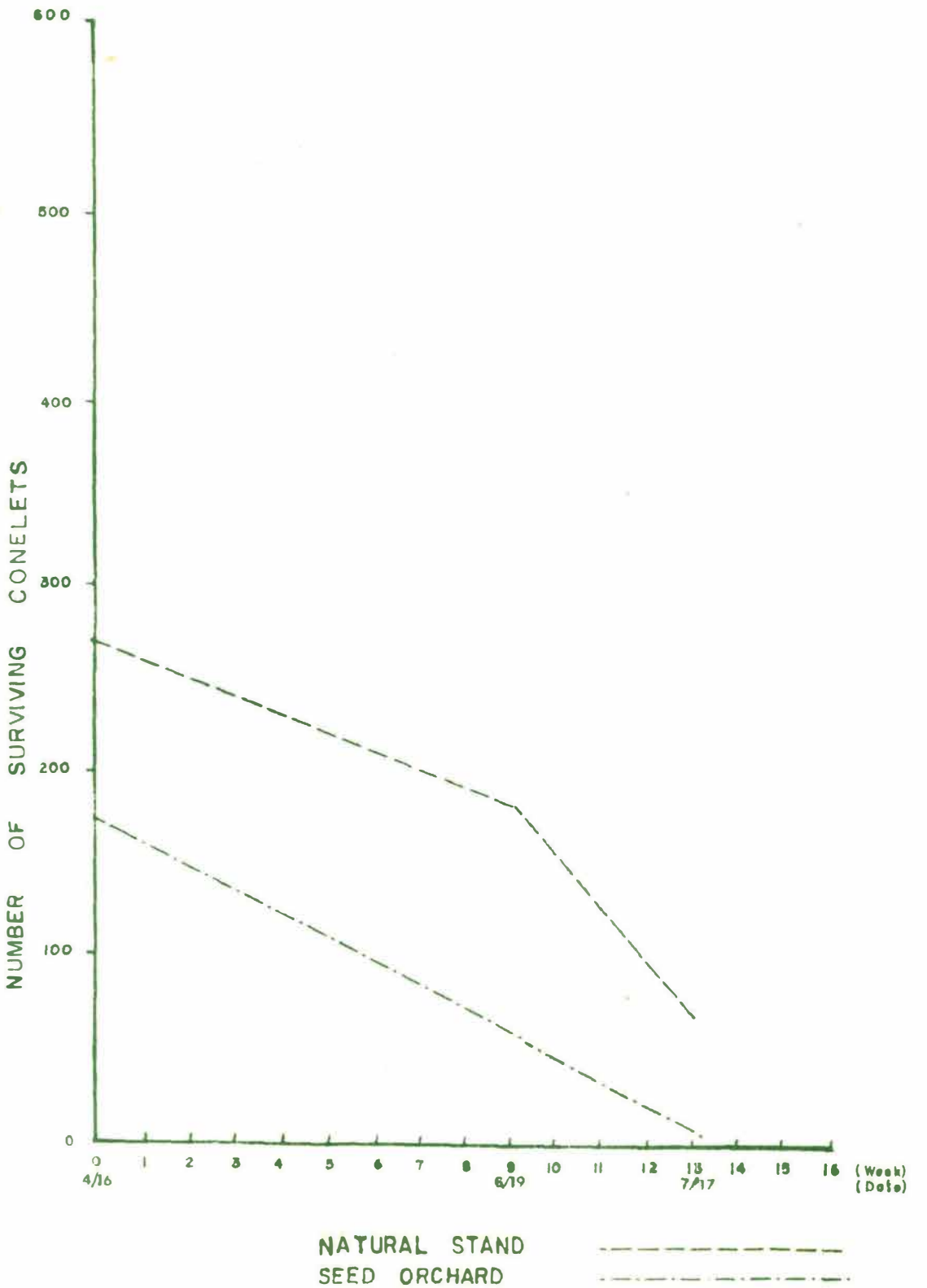


Fig. 5 NUMBER OF SURVIVING CONELETS FROM MARCH TO JULY ON THE FRANCIS MARION NATIONAL FOREST.

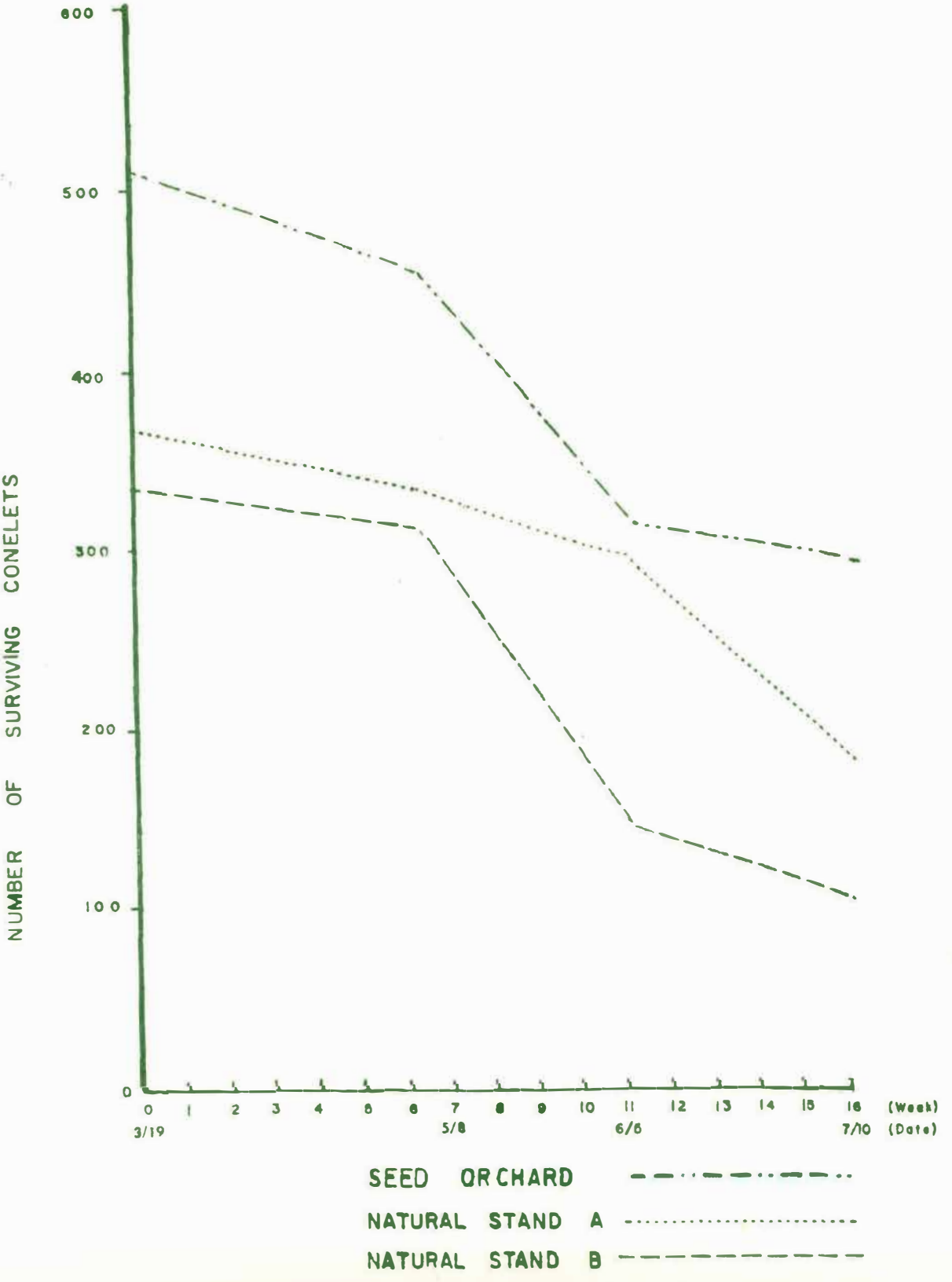


Table 1--Results of conelet inventory from March to September 1979 in the Bladen Lakes area.

	Number surviving and % loss per count				
	0 weeks (April 16-19)	9 weeks (June 19-22)		13 weeks (July 17-20)	
	Initial Count	# Remaining	% Loss	# Remaining	% Loss
Natural Stand	267	185	30.8	67	75
Seed Orchard	177	56	68.4	5	98

Table 2--Results of conelet inventory from March to September 1979 in the Francis Marion National Forest.

	Number surviving and % loss per count						
	0 weeks (March 19)	7 weeks (May 8-11)		11 weeks (June 5-8)		16 weeks (July 10-13)	
	Initial Count	# Remaining	% Loss	# Remaining	% Loss	# Remaining	% Loss
Natural Stand A (NSA)	365	345	5.5	297	18.6	186	49
Natural Stand B (NSB)	330	311	5.8	179	45.8	96	71
Seed Orchard	506	451	10.9	311	35.3	289	42

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